Magnetic and low-dissipation applications of topological materials at limited dimensions

Completed Technology Project (2017 - 2021)

Project Introduction

My research on topological materials at limited dimensions seeks to lay the groundwork for the next generation of magnetic sensors and low-dissipation circuitry. My research focuses on two compounds: WTe2, a type-II Weyl semimetal, and SnTe, a topological crystalline insulator. I plan to use intercalation and doping to tune the unique electrical properties of WTe2 and SnTe at the nanoscale, where the high surface to volume ratio accentuates the contributions from the topologically protected surface states. Additionally, I will develop novel strategies to mitigate the effects of surface oxidation, which degrades the electrical properties of these compounds. In my research, I will link synthesis to material properties through systematic physical, chemical, and electrical characterizations. The proposed applications based on these topological materials align with the main goal outlined in NASA Technology Roadmap TA 10: Nanotechnology to "provide an overall reduction in vehicle mass while enhancing efficiency, performance, and safety." This research path can be further focused by major area 10.4, "Sensors Electronics, and Devices." Collaboration with the NASA Visiting Technologist program will allow further investigation into the radiation stability of topological material based devices.

Anticipated Benefits

My research on WTe2 at limited dimensions seeks to lay the groundwork for the next generation of magnetic sensors and low-dissipation circuitry. The proposed applications based on WTe2 align with the main goal outlined in NASA Technology Roadmap TA 10: Nanotechnology to provide an overall reduction in vehicle mass while enhancing efficiency, performance, and safety.Collaboration with the NASA Visiting Technologist program will allow further investigation into the radiation stability of WTe2 devices.

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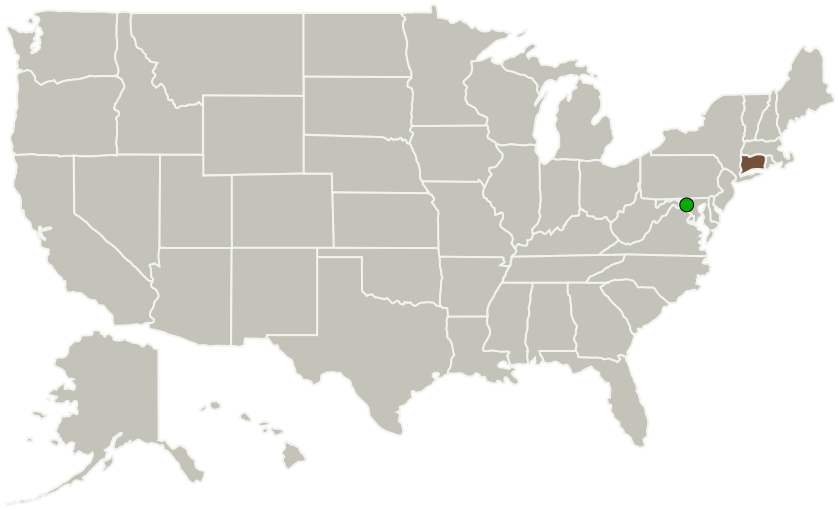
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Yale University	Lead Organization	Academia	New Haven, Connecticut
Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations
Connecticut

Project Website:

https://www.nasa.gov/strg#.VQb6T0jJzyE

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Yale University

Responsible Program:

Space Technology Research Grants

Project Management

Program Director:

Claudia M Meyer

Program Manager:

Hung D Nguyen

Principal Investigator:

Judy Cha

Co-Investigator:

John R Woods

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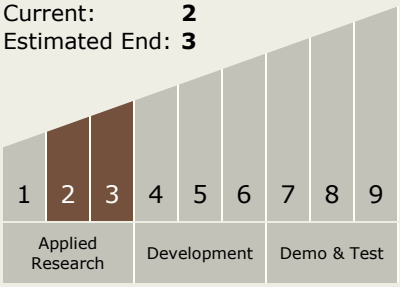
Technology Maturity (TRL)

Start: **2**
Current: **2**
Estimated End: **3**



Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.1 Materials
    - TX12.1.6 Materials for Electrical Power Generation, Energy Storage, Power Distribution and Electrical Machines

Target Destinations

The Moon, Mars, Earth